

ARI Research Note 2006-04

**Reanalysis of Validation of Tool to Assess
Readiness for Online Learning**

Huy A. Le and Christopher E. Sager
Human Resources Research Organization

Mark C. Young
U.S. Army Research Institute



**United States Army Research Institute
for the Behavioral and Social Sciences**

May 2006

Approved for public release; distribution is unlimited.

20060811009

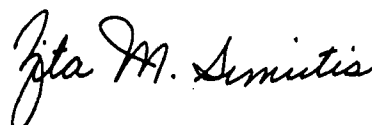
**U.S. Army Research Institute
for the Behavioral and Social Sciences**

**A Directorate of the Department of the Army
Deputy Chief of Staff, G1**

Authorized and approved for distribution:



**MICHELLE SAMS
Technical Director**



**ZITA M. SIMUTIS
Director**

Technical Review by

Amy J. Moorash, Army Continuing Education System

NOTICES

DISTRIBUTION: Primary distribution of this Research Note has been made by ARI. Please address correspondence concerning distribution of reports to: U.S. Army Research Institute for the Behavioral and Social Sciences, Attn: DAPE-ARI-MS, 2511 Jefferson Davis Highway, Arlington, Virginia 22202-3926

FINAL DISPOSITION: This Research Note may be destroyed when it is no longer needed. Please do not return it to the U.S. Army Research Institute for the Behavioral and Social Sciences.

NOTE: The findings in this Research Note are not to be construed as an official Department of the Army position, unless so designated by other authorized documents.

REPORT DOCUMENTATION PAGE

1. REPORT DATE (dd-mm-yy) January 2006		2. REPORT TYPE Final		3. DATES COVERED (from... to) September 2005 – February 2006	
4. TITLE AND SUBTITLE Reanalysis of Validation of Tool to Assess Readiness for Online Learning				5a. CONTRACT OR GRANT NUMBER DASW01-03-D-0015	
				5b. PROGRAM ELEMENT NUMBER 433709	
6. AUTHOR(S) Huy A. Le. and Christopher E. Sager (Human Resources Research Organization); Mark C. Young (U.S. Army Research Institute)				5c. PROJECT NUMBER 000	
				5d. TASK NUMBER	
				5e. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Human Resources Research Organization 66 Canal Center Plaza, Suite 400 Alexandria, Virginia 22314				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) U.S. Army Research Institute for the Behavioral and Social Sciences 2511 Jefferson Davis Highway Arlington, VA 22202-3926				10. MONITOR ACRONYM ARI	
				11. MONITOR REPORT NUMBER Research Note 2006-04	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release: distribution is unlimited.					
13. SUPPLEMENTARY NOTES Contracting Officer's Representative; Michael G. Rumsey; Subject Matter POC: Mark C. Young					
14. ABSTRACT (Maximum 200 words): Data originally collected to validate a questionnaire measuring Soldiers' readiness to attend the eArmyU were reanalyzed. eArmyU is a portal to online college level courses offered by a consortium of universities. The current study applies analytical procedures that provide methodological improvements to the original analysis. Specifically, exploratory and confirmatory factor analyses were sequentially used to select items and establish construct validities of the resulting scales. Next, a linear-based approach was applied to examine the scales' criterion-related validity. Scales measuring five theoretically relevant constructs – Motivation/Self-Determination, Intolerance of Ambiguity, Performance Goal Orientation, Need for Social Interaction, and Study Skills/Conscientiousness – were constructed from 53 items of the 90 original items. The scales have good psychometric properties and can reasonably predict the criterion of interest (multiple <i>R</i> adjusted for shrinkage is .23). Recommendations for future research that would further support the use of the questionnaire are made.					
15. SUBJECT TERMS eArmy U EArmyU Prep Questionnaire (EAPQ) Online learning validation Learning readiness Readiness for online learning Army Continuing Education System (ACES)					
16. REPORT Unclassified			17. ABSTRACT Unclassified		18. THIS PAGE Unclassified
19. LIMITATION OF ABSTRACT Unlimited			20. NUMBER OF PAGES		21. RESPONSIBLE PERSON (Name and Telephone Number) Ellen Kinzer Technical Publications Specialist (703) 602-8047

Standard Form 298

Research Note 2006-04

**Reanalysis of Validation of Tool to Assess
Readiness for Online Learning**

Huy A. Le and Christopher E. Sager
Human Resources Research Organization

Mark C. Young
U.S. Army Research Institute

Selection and Assignment Research Unit
Michael G. Rumsey, Chief

U.S. Army Research Institute for the Behavioral and Social Sciences
2511 Jefferson Davis Highway, Arlington, Virginia 22202-3926

May 2006

Army Project Number
433709000

Army Personnel

Approved for public release; distribution unlimited.

REANALYSIS OF VALIDATION OF TOOL TO ASSESS READINESS FOR ONLINE LEARNING

EXECUTIVE SUMMARY

Research Requirement:

Using contractors, the Army Continuing Education System (ACES) developed an assessment tool to determine Soldiers' readiness for online learning. A U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) review of the tool's evaluation report recommended that the validation results be re-analyzed using correlation-based approaches. This report describes the reanalysis of the original web-based eArmyU PReP Questionnaire (EAPQ) concurrent validation data and its results. In addition, it recommends (a) changes to the instrument (e.g., to the items selected for inclusion in the final measure) to improve its psychometric properties and (b) next steps for analysis of EAPQ data currently being collected.

Procedure:

After reviewing EAPQ items and the data base, statistical techniques were used to group similar EAPQ items together to create new proposed scales that were independent of each other. The psychometric characteristics of the new scales were evaluated to assess the extent to which they (a) measure unique human characteristics reliably and (b) relate to each other and student demographic information in a way that makes theoretical sense. Another set of statistical procedures was used to assess the extent to which these proposed scales are predictive of student pace in eArmyU coursework. Students varied on pace from four courses behind to four courses ahead of this standard. A final set of analyses assessed whether the scales' capacity to predict student pace was affected by gender or race/ethnic status.

Findings:

The original analyses of the EAPQ developed 12 scales using 90 items. The current analyses developed five independent scales using 53 of the 90 items. The scale development process revealed some concerns about some items and the data base. Ten items were dropped because they depend on the respondent already being enrolled in the eArmyU and this is not consistent with the EAPQ's intended - preenrollment - use. Additionally, some of the items showed statistical relationships with each other that do not make theoretical sense. This suggests the possibility that some of the items are not labeled correctly in the data base and could explain why a number of the remaining items were not assigned to the proposed scales.

Despite these concerns, 53 items were associated with five scales and the scale scores show relationships with each other supporting the hypothesis that they measure distinct characteristics that relate to each other and the relevant demographic characteristics in legitimate ways. This result is considered good support for the construct validity of the scale scores. The scales are titled (a) Motivation/Self-Determination, (b) Intolerance of Ambiguity, (c)

Performance Goal Orientation, (d) Need for Social Interaction, and (e) Study Skills/Conscientiousness.

The criterion-related validity evidence for the scales taken individually and as a group is good, but not spectacular. This means that the proposed scale scores can be considered reasonable predictors of a student's capacity to stay on pace in the eArmyU. However, it is important to note that the sample of 2,370 respondents is not representative of the population of 43,846 students who received the questionnaire with regard to their status on pace. In fact, the behind- and on-pace students are under-represented in this sample relative to ahead-of-pace students. The EAPQ's estimated capacity to predict pace would likely have been greater if the sample was more representative of the population.

Utilization and Dissemination of Findings:

This report's results support the idea that the EAPQ items are reasonably predictive of readiness for participation in the eArmyU. However, it is recommended that more work be done to show that these results generalize beyond the data set and sample of respondents examined here. Similar analyses could be conducted using EAPQ responses from an independent sample of Soldiers currently enrolled in eArmyU. Such analyses would provide additional evidence to support the use of the EAPQ for helping Soldiers determine their readiness for matriculation into the eArmyU program.

REANALYSIS OF VALIDATION OF TOOL TO ASSESS READINESS FOR ONLINE LEARNING

CONTENTS

	Page
Introduction.....	1
Brief Background.....	2
Sample.....	2
Measures	2
Demographic Variables	2
Criterion	2
Predictors	3
Analyses and Results	3
Review of Items	3
Review of Data Set	4
Demographics	4
Scale Development	7
Individual Item Statistics	7
Factor Analysis	9
Scale Statistics	14
Criterion-Related Validity	17
Differential Prediction	18
Discussion.....	18
Summary of Results.....	18
Implication for Current Use of the Questionnaire	19
Recommendation for Future Research.....	20
References.....	21
Appendix A Items and Their Final Scale Assignments	A-1

REANALYSIS OF VALIDATION OF TOOL TO ASSESS READINESS FOR ONLINE LEARNING

CONTENTS (Continued)

Page

List of Tables

Table 1. Distribution of Gender	4
Table 2. Distribution of Race/Ethnic Subgroups	4
Table 3. Distribution of Age	5
Table 4. Distribution of Level of Education	5
Table 5. Distribution of Pay Grade	5
Table 6. Distribution of Years in the Army	6
Table 7. Distribution of Computer Courses Take Before eArmyU	6
Table 8. Distribution of Terms in eArmyU	6
Table 9. Distribution of Number of Hours in eArmyU	6
Table 10. Distribution of Pace for Population and Sample	7
Table 11. Item Statistics and Correlations with the Criterion.....	8
Table 12. Exploratory Factor Analysis Results: Loadings of the Items on the Factors.....	11
Table 13. Definitions of Proposed Factors	12
Table 14. Confirmatory Factor Analysis Results: Estimated Standardized Loadings of the Items on Assigned Factors	13
Table 15. Scale Statistics	15
Table 16. Scale Intercorrelations	15
Table 17. Gender Differences	16
Table 18. Race/Ethnicity Differences	16
Table 19. Correlations Between the Scales and Demographic Variables.....	16
Table 20. Zero-Order Correlations with the Criterion	17
Table 21. Regression Analysis with All the Scales Predicting the Criterion Concurrently	17

REANALYSIS OF VALIDATION OF TOOL TO ASSESS READINESS FOR ONLINE LEARNING

Introduction

Through a contract to Booz Allen Hamilton (BAH), the Army Continuing Education System (ACES) developed an assessment tool to determine Soldiers' readiness for online learning. BAH subcontracted that work to a company named ComFit LLC. A U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) review of the tool's evaluation report recommended that the validation results be re-analyzed using correlation-based approaches. This report describes the reanalysis of the original web based eArmyU PReP Questionnaire (EAPQ) concurrent validation data and its results. In addition, it recommends (a) changes to the instrument (e.g., to the items selected for inclusion in the final measure) to improve its psychometric properties and (b) next steps for analysis of EAPQ data currently being collected.

Taken together the analyses and this report have the following goals:

- Develop EAPQ scale scores that assess relatively independent constructs.
EAPQ items from all the original scales were examined to identify similar items that group together, create new scales, and evaluate their independence. Two EAPQ scales (e.g., Time Management and Tolerance for Ambiguity) are independent from each other if scores on one scale are not highly related to scores on the other scale. Independence means that the two scales measure two different human characteristics. However, if scores on one scale (e.g., Attitude Towards Intelligence: Fixed or Malleable) are very highly related to scores on another scale (e.g., Locus of Control), these scores are not independent. This suggests that they probably measure the same characteristic, and therefore should be combined into a single scale.
- Assess the internal consistency reliability of the resulting scores.
Internal consistency reliability is a value between 0 and 1.00 that assesses the extent to which the items on the scale are measuring the same characteristic. Showing that a scale is measuring a single characteristic is generally viewed as the first step towards making sure that the scale is assessing the characteristic it is designed to measure.
- Examine the construct validity of the scores.
Construct validity asks the big overall question: "Does the scale measure what it is supposed to measure?" There are a number of ways to gather evidence to support this inference. This report assesses whether (a) the scales are independent, (b) items on each scale measure a single characteristic, (c) scales relate to each other in a way that is consistent with the literature, and (d) scales relate to the assessed demographic variables (e.g., level of education) in ways that make sense.
- Estimate the criterion-related predictive validity of the scores.
In this context, criterion-related validity assesses the extent to which the scales, either taken individually and/or all together, predict scores on the outcome of interest (i.e., the criterion). In this case the criterion is pace (i.e., progress relative to expectation in the eArmyU program). Essentially, this looks at whether higher scale scores suggest

higher pace scores. If so, then EAPQ scales are correlated with pace and, in turn, predict pace. If the EAPQ scales predict pace and have reasonable construct validity, then the EAPQ is probably a good tool for assessing whether Soldiers are prepared to enter eArmyU.

- Make recommendations for future research.

Based on the results of the analyses in this report, we make recommendations for analysis of a new data set consisting of currently collected EAPQ data. One recommendation is to examine whether the recommended organization of items into scales generalizes to the current EAPQ. The current EAPQ is a modified version of the questionnaire analyzed in this report. Another is to assess the criterion-related validity of the scales in the population of eArmyU participants.

Brief Background

The operational goal for the EAPQ is to help ACES counselors (a) determine whether Soldiers are prepared to be successful in the eArmyU and (b) give feedback to Soldiers who need additional preparation. eArmyU is a portal to online college level courses offered by a consortium of universities. ACES counselors have other sources of information available to inform their decision (e.g., the General Technical (GT) composite from the Armed Services Vocational Aptitude Battery (ASVAB), scores from the Test for Adult Basic Education (TABE), and grade point averages (GPAs) from past educational experiences). However, these and other predictors are not used in a predetermined way (e.g., a prescribed formula or algorithm); rather, the counselor makes a holistic judgment about whether to recommend the Soldier for matriculation into the eArmyU.

Sample

These analyses examined the EAPQ responses from the 2,370 enlisted Soldiers who participated in the concurrent validation effort between March 5, 2004 and June 25, 2004. The EAPQ was sent to the population of 43,846 eArmyU students. "Concurrent validation" refers to the fact that the Soldiers/students who received and responded to the questionnaire were enrolled in the eArmyU at the time.

Measures

Demographic Variables

The EAPQ queried students on 11 demographic variables. They included (a) gender, (b) race/ethnicity, (c) age, (d) marital status, (e) number of children, (f) level of education, (g) pay grade, (h) years in the Army, (i) number of computer number courses taken before eArmyU, (j) number of terms in eArmyU, and (k) number of hours completed in eArmyU.

Criterion

We created a new criterion variable, "Pace," that indicates the standing of a student relative to his/her expected progression in the eArmyU program. Pace was obtained from the original categorical variable "group membership," which divided students into nine groups

ranging from four courses behind pace to four courses ahead of pace. As such, the Pace variable has values from -4 to 4. We treat this variable as continuous based on the assumption that it is reasonable to view Pace as a continuous construct.¹

Predictors

The original validation analyses derived the following 12 scale scores from 90 EAPQ items:

- Computer Self-Efficacy
- Time Management
- Study Skills
- Metacognitive Awareness
- Motivation/Mastery
- Personal Self-Efficacy
- Fixed Intelligence
- Need for Cognition
- Locus of Control
- Tolerance for Ambiguity
- Need for Social Interaction
- Adequate Time for Studying.²

Each item was rated on a 5-point Likert agreement scale (i.e., 1 = Disagree Strongly to 5 = Agree Strongly.)

Analyses and Results

This section describes the analyses and presents their results. It starts out with a review of the text of each item and of the data set that was used in the original validation work and is being reanalyzed in this report. Next, relevant demographic data that were collected along with the EAPQ are examined, with a particular emphasis on comparing the distribution of the Pace criterion in the population of eArmyU students who received the questionnaire to its distribution for the students who responded. Pace is the only variable for which we have the population values. This is followed by a description of the development of new EAPQ scales. Finally, the criterion-related validity analyses are described and their results reviewed.

Review of Items

Appendix A shows the full text of all 90 EAPQ items, organized by their final scale assignment. Before the statistical analyses were performed, each item was reviewed for its

¹ To maintain anonymity, the concurrent validation participants' Social Security Numbers (SSNs) were not requested or saved. This means that other potential criteria, like eArmyU grade point average (GPA), are not accessible for this sample.

² Because SSNs were not collected, as noted above, scores on other potential predictors are not accessible (e.g., ASVAB GT and TABE scores).

relevance to these analyses. This resulted in 10 items being dropped from further analysis. The first six items are pairs; one of each pair asks about the student's status before beginning eArmyU while the other asks about the student's status now (after the student has been in eArmyU for some time). Given the intended (preenrollment) use of this instrument, items asking about the student's status during participation in eArmyU were eliminated from further analysis (i.e., items 2, 4, and 6). Likewise, items 9, 10, and 86 through 90 were eliminated from further analysis because they depend too much on the student being enrolled in eArmyU (e.g., Item 9: "My lack of computer skills or Internet knowledge often interferes with my ability to do my best work in the eArmyU courses I take"). Items 11, 12, 44, and 85 refer to the eArmyU and need to be rewritten; however, they were included in further analyses because the judgment was made that this reference does not adversely affect their relevance in this context.

Review of Data Set

The data set we reviewed had 2,370 useable cases. It had missing data for items 86 through 90 for all but a few participants. This was not a problem for the analyses because, as indicated above, they were eliminated from further analysis for other reasons. However, this caused us to be a little worried about whether the responses for each item were correctly matched with the item/variable titles at the top of each column. This issue is discussed in more detail in the Scale Development section of this report.

Demographics

This section presents the frequency results for the demographic variables, the first of which is gender (see Table 1).

Table 1. Distribution of Gender

Gender	Number	Percent
Male	1,872	79.0
Female	498	21.0
Total	2,370	100.0

Table 2 shows the distribution of race/ethnicity responses. Together Tables 1 and 2 show enough female, black, and Hispanic participants to investigate gender and race/ethnicity differences of EAPQ scale scores and conduct bias analyses relative to their prediction of the Pace criterion.

Table 2. Distribution of Race/Ethnic Subgroups

Race	Number	Percent
American Indian or Alaska Native	30	1.3
Asian or Pacific Islander	50	2.1
Black non-Hispanic	548	23.1
Spanish/Hispanic/Latino	285	12.0
White non-Hispanic	1,355	57.2
Other	102	4.3
Total	2,370	100.0

Table 3 shows the distribution of age in this sample. The large number of respondents 31 years of age or older is interesting.

Table 3. Distribution of Age

Age Range	Number	Percent
20 or Younger	72	3.0
21 – 25	332	14.0
26 – 30	412	17.4
31 or Older	1,554	65.6
Total	2,370	100.0

Table 4 shows the distribution of education level across participants. A large percentage of respondents have some college.

Table 4. Distribution of Level of Education

Education Level	Number	Percent
High school degree or equivalent	220	9.3
Some college courses	1,493	63.0
Associate degree	514	21.7
Bachelor's degree	76	3.2
Some graduate courses	57	2.4
Graduate degree or higher	10	0.4
Total	2,370	100.0

Table 5 shows the distribution of pay grades across participants. All pay grades have some representation. The distribution looks somewhat normal with a negative skew. The significant representation of E6 through E9 Soldiers is consistent with the age distribution shown in Table 3.

Table 5. Distribution of Pay Grade

Pay Grade	Number	Percent
E1	11	0.5
E2	17	0.7
E3	67	2.8
E4	267	11.3
E5	431	18.2
E6	685	28.9
E7	660	27.8
E8	188	7.9
E9	44	1.9
Total	2,370	100.0

Table 6 shows the distributions of years in the Army. The large percentage of responses in the "Four or more" category is consistent with results shown in Tables 4 and 5.

Table 6. Distribution of Years in the Army

Years in the Army	Number	Percent
One or less	46	1.9
More than one less than two	61	2.6
Two to three	134	5.7
More than three less than four	93	3.9
Four or more	2,036	85.9
Total	2,370	100.0

Table 7 shows the distribution of computer-based courses taken before entering the eArmyU program. This is a somewhat bimodal distribution with a large percentage of participants (51.3%) reporting no previous experience and the next largest percentage reporting five classes or more (21.6%).

Table 7. Distribution of Computer Courses Take Before eArmyU

Number of Courses Taken	Number	Percent
None	1,215	51.3
One	175	7.4
Two	215	9.1
Three	153	6.5
Four	99	4.2
Five or more	513	21.6
Total	2,370	100.0

Table 8 shows the distribution of terms enrolled in the eArmyU and Table 9 shows the distribution of number of course hours completed in the eArmyU. These tables show that most of the sample had been enrolled between two and five terms and that the distribution of hours completed was bimodal with a number of Soldiers at the bottom (i.e., 0 – 3 hours) and top (i.e., More than 12).

Table 8. Distribution of Terms in eArmyU

Number of Terms in eArmyU	Number	Percent
One	620	26.2
Two to five	1,234	52.1
More than five	516	21.8
Total	2,370	100.0

Table 9. Distribution of Number of Hours in eArmyU

Number of Hours	Number	Percent
0 – 3	805	34.0
4 – 6	323	13.6
7 – 9	156	6.6
8 – 12	333	14.1
More than 12	753	31.8
Total	2,370	100.0

Frequency distributions for marital status and number of children are not reported because these variables are not relevant for this report and they did not reveal any aberrant results to cause concern.

Table 10 shows the distribution of the Pace criterion for the population of students who received the EAPQ and the sample of students who provided useable responses. This table shows that behind- and on-pace students are under-represented in this sample relative to ahead-of-pace students. This sample distribution looks very much like it suffered from indirect range restriction relative to the population. In this case, indirect range restriction means that a third variable (e.g., motivation to respond) positively correlated with Pace influenced response rates. The difficulty is that we cannot correct correlations between EAPQ scale scores and Pace for indirect range restriction because we do not have data on the third variable. This range restriction means that it is likely that these results will underestimate the relationships between the scales and the Pace criterion in the population of interest.

Table 10. Distribution of Pace for Population and Sample

Pace	Population		Sample		Percent Response Rate
	Number	Percent	Number	Percent	
-4	2,267	5.17	1	0.04	0.04
-3	3,879	8.85	7	0.30	0.18
-2	5,089	11.61	42	1.77	0.83
-1	4,577	10.44	93	3.92	2.03
0	10,495	23.94	385	16.24	3.67
1	7,059	16.10	448	18.90	6.35
2	4,461	10.17	503	21.22	11.28
3	2,324	5.30	280	11.81	12.05
4	3,695	8.43	611	25.78	16.54
Total	43,846	100.00	2,370	100.00	5.41

Note. Pace is a variable that varies from -4 to 4. -4, 4, and 0 refers to four courses behind pace, four courses ahead of pace, and on pace, respectively.

Scale Development

Because the items on the EAPQ were rationally selected from relatively diverse domains, the extent to which the constructs underlying those measures are redundant is not clear. Accordingly, the approach for establishing relatively independent scales and examining their construct validity involved two steps: (a) empirically determining the factors (i.e., latent constructs) underlying the items, and (b) examining the patterns of relationships among the resulting scales and with other relevant variables (e.g., gender, race/ethnicity, and education level). However, preliminary to these steps, the statistics for individual items were examined to identify potential problems with particular items.

Individual Item Statistics

Table 11 shows basic distribution statistics for each item (i.e., minimum, maximum, mean, and standard deviation). Note that items 2, 4, 6, 9, 10, and 86 through 90 are not listed because, as indicated above, they were eliminated from further analyses. None of the items show out of range responses or other distributional characteristics that cause concern. The last column shows each item's correlation with the Pace criterion. The bolded correlations are significant (p

< .01); this means that they are statistically significantly different from zero. Some individual items show substantial correlations with the Pace criterion. For example questions 3, 15, and 83 correlate .23, .19, and .17, respectively, with the Pace criterion.

Table 11. Item Statistics and Correlations with the Criterion

Item	Brief Description	Minimum	Maximum	Mean	SD	Correlation with the Criterion (Pace)
1	strongComputerSkillsBefore	1	5	4.19	0.91	0.16
3	academicConfidenceBefore	1	5	4.35	0.87	0.23
5	personalConfidenceBefore	1	5	4.54	0.77	0.11
7	confusedWithBasicFunctions	1	5	2.59	1.21	-0.05
8	spendAsMuchTimeSurfingAsPossible	1	5	2.48	1.39	-0.04
11	typingSkillsBefore	1	5	3.59	1.27	0.02
12	chatSessionsOftenBefore	1	5	3.73	1.04	0.06
13	trackScheduleSystematically	1	5	4.05	1.03	0.04
14	canGaugeScheduleAccurately	1	5	2.63	1.15	-0.12
15	useToDoList	1	5	3.88	0.98	0.19
16	canMultiTaskOk	1	5	3.36	1.15	0.03
17	didAssignmentsOnTimeInSchool	1	5	3.77	1.04	0.04
18	hardToStickToSchedule	1	5	4.39	0.71	0.05
19	keepUpWithReadings	1	5	3.63	1.04	0.04
20	outlineMaterials	1	5	2.56	1.21	-0.05
21	skimNewMaterial	1	5	3.90	0.82	0.06
22	revisitConfusingMaterial	1	5	3.89	0.85	0.08
23	organizeNotes	1	5	3.97	0.87	0.12
24	procrastinateStudying	1	5	3.91	0.85	0.11
25	considerAlternatives	1	5	4.11	0.80	0.06
26	setGoals	1	5	3.92	0.90	0.13
27	awareOfExpectations	1	5	3.85	0.95	0.02
28	periodicallyReview	1	5	4.17	0.78	0.07
29	chooseBestSolution	1	5	3.77	0.90	0.10
30	awareOfStudyStrategies	1	5	3.78	0.93	0.06
31	createOwnExamples	1	5	3.85	0.91	0.07
32	goodJudgeOfComprehension	1	5	4.42	0.74	0.05
33	havePurposeForEachStudyStrategy	1	5	4.10	1	0.05
34	changeStrategiesWhenNotWorking	1	5	4.62	0.65	0.08
35	breakDownStudyingToSmallSteps	1	5	3.88	1.17	0.04
36	importantToUnderstandThoroughly	1	5	4.09	0.85	0.04
37	importantToDoBetterThanOthers	1	5	3.63	1.03	-0.04
38	wantToLearnAsMuchAsPossible	1	5	4.53	0.66	0.13
39	fearOfFailureOftenMotivates	1	5	4.33	0.77	0.11
40	desireToCompletelyMasterMaterial	1	5	4.11	0.97	-0.01
41	afraidOfNotUnderstandingEnough	1	5	4.48	0.85	0.08
42	expectToDoWell	1	5	3.91	1.19	-0.04
43	believeWillReceiveExcellentGrades	1	5	4.35	0.74	0.10
44	confidentAboutDoingWellWhenEnrolled	1	5	4.35	0.76	0.15
45	primaryReasonEnhanceCareerOpsCivilian	1	5	4.03	0.88	0.12
46	primaryReasonEnhanceCareerOpsMilitary	1	5	4.49	0.71	0.08
47	certainICanmasterSkills	1	5	4.04	0.81	0.07

Table 11. (Continued)

Item	Brief Description	Minimum	Maximum	Mean	SD	Correlation with the Criterion (Pace)
48	certainICanDoCoursework	1	5	4.40	0.72	0.15
49	canFigureOutMostDifficult	1	5	4.29	0.76	0.08
50	canDoAlmostAllIfPersistent	1	5	4.32	0.78	0.07
51	certainCanRememberInformation	1	5	2.38	1.12	-0.06
52	certainCanSelfMotivate	1	5	2.90	1.07	-0.05
53	canLearnEvenIfHard	1	5	3.16	1.12	-0.06
54	canDoHardestIfITry	1	5	4.00	0.82	0.03
55	ratherDoLessChallenging	1	5	3.70	0.94	0.05
56	preferSmallDailyProjects	1	5	2.56	1.11	-0.05
57	likeTasksRequireLittleThought	1	5	3.30	1.05	-0.02
58	enjoyTasksRequiringNewSolutions	1	5	2.04	1.11	-0.05
59	preferImportantTasks	1	5	2.01	1.16	-0.05
60	dontCareHowItWorks	1	5	1.93	1.12	-0.08
61	deliberateAboutIssues	1	5	3.44	1.00	0.06
62	haveCertainFixedIntelligence	1	5	2.51	1.04	-0.05
63	cantChangeIntelligenceMuch	1	5	1.62	0.90	-0.09
64	cantIncreaseBasicIntelligence	1	5	3.21	0.97	0.00
65	usuallyGetWhatIWant	1	5	4.14	0.93	0.06
66	neverKnowWhereIStand	1	5	2.16	0.99	-0.08
67	giveUpWhenNotEasy	1	5	4.38	0.78	0.02
68	convinceOtherOfMyWay	1	5	4.61	0.65	0.06
69	mustMasterOwnFate	1	5	1.78	0.96	-0.05
70	neverTryThingsUnsureOf	1	5	3.25	1.14	-0.05
71	earnMyRespect	1	5	3.24	1.15	-0.05
72	persistenceHardWorkLeadToSuccess	1	5	4.01	0.84	0.02
73	othersControlMyLife	1	5	4.20	0.85	0.04
74	impatientWhenNoClearAnswers	1	5	3.28	1.20	-0.02
75	frustratedWhenCantGrip	1	5	3.35	1.07	-0.10
76	whenUnclearImpulseIsToClarify	1	5	3.16	1.06	-0.07
77	cantStandLeavingUndone	1	5	2.76	1.14	-0.09
78	dontPerformWellWithVagueExpectations	1	5	2.55	1.17	-0.13
79	preferLearningInCommunity	1	5	3.25	1.16	-0.09
80	importantToKnowInstructor	1	5	3.78	1.07	-0.05
81	likeCoursesWithGroupWork	1	5	4.48	0.73	0.13
82	preferGroupToSoloAssignments	1	5	3.47	1.24	0.14
83	learnBetterDiscussingWithOthers	1	5	3.77	1.12	0.17
84	enjoyLearningFromOthers	1	5	2.94	1.39	0.12
85	completingArmyUHighPriority	1	5	3.52	1.26	0.05

Note. $n = 2,370$. Bolded correlations are significant, $p < .01$.

Factor Analysis

To identify the factors underlying the EAPQ items, exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were used sequentially. This approach is helpful to develop scales when the items are generated based on constructs from diverse theoretical domains (Le, Casillas, Robbins, & Langley, 2005). First, we split the sample into two sub-samples. The

exploratory sample included about two-thirds of the total sample. The confirmatory (i.e., hold-out) sample included the remaining one-third of the total sample.

EFA was carried out using two-thirds of the total sample (the exploratory sample, $n = 1,551$). Principal axis factoring was used for extraction and the extracted factors were rotated using an oblique rotation method (i.e., oblimin). Based on the scree-plot and factor interpretability, a five-factor solution was selected. Table 12 shows the loadings on each factor. The five factors, account for about 34% of the total variance in the 80 items and are tentatively titled (a) Motivation/Self-Determination, (b) Intolerance of Ambiguity,³ (c) Performance Goal Orientation, (d) Need for Social Interaction, and (e) Study Skills/Conscientiousness. These factors are reasonable when compared to past research. A recently developed instrument designed to assess student readiness for college found factors very similar to Motivation/Self-Determination and Study Skills/Conscientiousness and a factor somewhat similar to Need for Social interaction (Le et al., 2005). The Intolerance for Ambiguity items held together fairly well. This construct has a research history, and has recently been being shown to be predictive of U.S. Army noncommissioned officer (NCO) job performance (Putka, Kilcullen, & White, 2004). The Performance Goal Orientation factor is a combination of items generally related to confidence and the belief that cognitive ability is not changeable (Bell & Kozlowski, 2002; Kozlowski, Gully, Brown, Salas, Smith, & Nason, 2001). Table 13 proposes definitions of each factor.

The bolded loadings in Table 12 indicate the factor to which the item was assigned. In most cases the loading was .30 or higher and it made theoretical sense. For example, it makes theoretical sense that Item 38 (I want to learn as much as possible in any course I take) has a relatively high loading (.72) on the Motivation/Self-Determination factor and relatively low loadings on other factors. These were the 59 items that were included in the subsequent CFA.

Twenty-one items were not assigned to a factor because they (a) did not load substantially on any factor (i.e., a loading of .30 or greater) or (b) the pattern of loadings did not make sense (i.e., items 7, 8, 12, 13, 14, 20, 37, 41, 54, 55, 57, 61, 64, 65, 67, 68, 69, 72, 73, 74, 85). A number of items with substantial loadings on factors that do not make theoretical sense cause some concern. For example, Item 67 (If I do not succeed on a task, I tend to give up) had a substantial positive loading on the Motivation/Self-Determination (.42) and a small negative loading on Performance Goal Orientation (-.15). Theoretically, this item should have a negative loading on Motivation/Self-Determination and/or a strong positive loading on Performance Goal Orientation. Item 13 (I have a systematic way [for example, an appointment book, diary, electronic calendar, or other method] to keep track of my daily and weekly schedule) is another example. It had a relatively high negative loading on Need for Social Interaction when theoretically it should have a relatively high positive loading on Study Skills/Conscientiousness. This observation taken with the missing data for the last four items suggests that the match between item/variable titles and item responses in the data set might not be 100% accurate.

³ The construct Tolerance for Ambiguity was renamed Intolerance of Ambiguity to be consistent with the scaled direction of the items assessing it.

Table 12. Exploratory Factor Analysis Results: Loadings of the Items on the Factors

Item	Item Brief Description	Motivation/ Self- Determination	Intolerance of Ambiguity	Performance Goal Orientation	Need for Social interaction	Study Skills/ Conscien- tiousness
1	strongComputerSkillsBefore	0.28	-0.13	0.03	0.16	-0.17
3	academicConfidenceBefore	0.37	-0.15	0.03	0.24	-0.18
5	personalConfidenceBefore	0.43	-0.10	-0.01	0.12	-0.11
7	confusedWithBasicFunctions	0.07	0.08	0.18	0.00	-0.06
8	spendAsMuchTimeSurfingAsPossible	0.06	0.06	0.13	0.06	-0.04
11	typingSkillsBefore	-0.05	0.00	0.01	0.00	-0.44
12	chatSessionsOftenBefore	0.09	-0.11	-0.02	0.19	-0.29
13	trackScheduleSystematically	0.20	-0.01	-0.01	0.10	-0.20
14	canGaugeScheduleAccurately	-0.02	0.08	0.19	-0.33	0.16
15	useToDoList	0.23	-0.01	-0.05	0.22	-0.25
16	canMutiTaskOk	-0.07	0.16	0.02	0.05	-0.53
17	didAssignmentsOnTimeInSchool	0.02	0.09	-0.01	-0.01	-0.51
18	hardToStickToSchedule	0.39	-0.01	-0.09	-0.11	-0.31
19	keepUpWithReadings	-0.04	0.11	-0.03	-0.02	-0.62
20	outlineMaterials	0.03	-0.09	0.28	-0.15	0.25
21	skimNewMaterial	0.07	0.00	-0.03	-0.07	-0.53
22	revisitConfusingMaterial	-0.01	0.00	-0.07	-0.03	-0.68
23	organizeNotes	0.25	-0.04	-0.01	0.18	-0.34
24	procrastinateStudying	0.08	0.07	-0.03	0.05	-0.57
25	considerAlternatives	0.08	0.03	-0.02	-0.06	-0.65
26	setGoals	-0.01	-0.04	-0.02	0.06	-0.74
27	awareOfExpectations	0.04	0.00	0.04	-0.02	-0.57
28	periodicallyReview	0.26	-0.16	-0.04	0.02	-0.47
29	chooseBestSolution	0.01	-0.07	0.03	0.06	-0.73
30	awareOfStudyStrategies	0.10	0.02	0.03	-0.05	-0.52
31	createOwnExamples	0.04	0.04	0.03	-0.04	-0.59
32	goodJudgeOfComprehension	0.47	0.14	-0.11	-0.09	-0.21
33	havePurposeForEachStudyStrategy	0.44	0.05	0.01	-0.03	-0.06
34	changeStrategiesWhenNotWorking	0.58	0.11	-0.15	-0.10	-0.10
35	breakDownStudyingToSmallSteps	0.33	0.12	0.13	-0.17	0.03
36	importantToUnderstandThoroughly	0.45	0.12	-0.06	-0.01	-0.20
37	importantToDoBetterThanOthers	0.19	0.17	0.18	-0.31	0.08
38	wantToLearnAsMuchAsPossible	0.72	-0.03	-0.07	0.01	-0.07
39	fearOfFailureOftenMotivates	0.63	-0.07	-0.08	0.08	-0.10
40	desireToCompletelyMasterMaterial	0.37	-0.02	0.02	0.13	-0.12
41	afraidOfNotUnderstandingEnough	0.39	0.08	0.00	-0.04	-0.03
42	expectToDoWell	0.25	0.12	0.04	-0.04	0.02
43	believeWillReceiveExcellentGrades	0.66	-0.03	-0.02	0.16	-0.08
44	confidentAboutDoingWellWhenEnrolled	0.61	-0.01	-0.07	0.20	-0.06
45	primaryReasonEnhanceCareerOpsCivilian	0.50	-0.13	-0.04	0.24	-0.12
46	primaryReasonEnhanceCareerOpsMilitary	0.70	-0.05	-0.03	0.09	0.00
47	certainICanmasterSkills	0.45	0.03	-0.07	0.19	-0.23
48	certainICanDoCoursework	0.66	-0.04	-0.09	0.17	-0.12
49	canFigureOutMostDifficult	0.63	-0.05	-0.11	0.16	-0.10
50	canDoAlmostAllIfPersistent	0.64	-0.04	-0.10	0.17	-0.06
51	certainCanRememberInformation	-0.04	-0.03	0.55	-0.02	0.11
52	certainCanSelfMotivate	0.07	-0.04	0.48	-0.09	0.12
53	canLearnEvenIfHard	0.15	0.00	0.45	-0.11	0.07
54	canDoHardestIfITry	0.21	0.11	-0.14	-0.02	-0.35
55	ratherDoLessChallenging	0.24	0.02	-0.06	0.03	-0.21
56	preferSmallDailyProjects	0.00	-0.06	0.46	0.06	0.11

Table 12. (Continued)

Item	Item Brief Description	Motivation/ Self- Determination	Intolerance of Ambiguity	Performance Goal Orientation	Need for Social interaction	Study Skills/ Conscien- tiousness
57	likeTasksRequireLittleThought	0.09	0.02	0.14	-0.14	-0.20
58	enjoyTasksRequiringNewSolutions	-0.27	-0.03	0.68	0.16	-0.15
59	preferImportantTasks	-0.26	0.01	0.64	0.15	-0.15
60	dontCareHowItWorks	-0.25	-0.04	0.63	0.14	-0.08
61	deliberateAboutIssues	0.23	-0.11	0.01	0.10	-0.17
62	haveCertainFixedIntelligence	-0.04	0.05	0.30	-0.10	0.05
63	cantChangeIntelligenceMuch	-0.16	0.01	0.47	0.03	0.12
64	cantIncreaseBasicIntelligence	0.14	-0.22	0.09	-0.08	-0.15
65	usuallyGetWhatIWant	0.28	-0.01	-0.05	-0.11	-0.16
66	neverKnowWhereIStand	-0.11	0.09	0.41	0.00	-0.08
67	giveUpWhenNotEasy	0.42	-0.02	-0.15	-0.14	-0.13
68	convinceOtherOfMyWay	0.51	0.05	-0.16	-0.16	-0.10
69	mustMasterOwnFate	-0.16	0.04	0.29	-0.07	0.06
70	neverTryThingsUnsureOf	0.16	-0.04	0.35	-0.37	0.03
71	earnMyRespect	0.13	-0.02	0.33	-0.42	0.04
72	persistenceHardWorkLeadToSuccess	0.28	-0.05	0.06	-0.24	-0.23
73	othersControlMyLife	0.28	0.00	-0.07	-0.18	-0.25
74	impatientWhenNoClearAnswers	0.09	0.01	0.24	-0.24	0.01
75	frustratedWhenCantGrip	0.08	0.60	0.05	-0.04	-0.02
76	whenUnclearImpulselsToClarify	0.10	0.56	0.07	-0.05	-0.11
77	cantStandLeavingUndone	-0.06	0.79	0.01	0.14	-0.09
78	dontPerformWellWithVagueExpectations	-0.13	0.75	0.05	0.10	-0.07
79	preferLearningInCommunity	0.03	0.76	-0.01	-0.01	0.00
80	importantToKnowInstructor	0.12	0.64	-0.14	0.03	-0.09
81	likeCoursesWithGroupWork	0.56	0.11	-0.03	0.06	-0.02
82	preferGroupToSoloAssignments	0.36	0.02	0.10	0.63	0.11
83	learnBetterDiscussingWithOthers	0.43	-0.02	0.08	0.62	0.06
84	enjoyLearningFromOthers	0.23	0.06	0.15	0.55	0.03
85	completingArmyUHighPriority	0.19	0.10	0.06	0.38	-0.10

Note. $n = 1,551$. Bolded loadings on assigned factors (in most cases, it means loading of .30 or higher).

Table 13. Definitions of Proposed Factors

Title	Definition
Motivation/ Self-Determination	The extent to which students are motivated, purposeful, and self-confident.
Intolerance of Ambiguity	The extent to which students feel uneasy when dealing with uncertain aspects of their studies; students' inability to cope with uncertainty.
Performance Goal Orientation	The extent to which students (a) have confidence on their own abilities, (b) believe that abilities don't change, and (c) are self-conscious about their performance relative to others.
Need for Social Interaction	The extent to which students prefer working collaboratively with others.
Study Skills/ Conscientiousness	The extent to which students know how to manage time and other cognitive resources and consistently apply this knowledge to improve their study outcomes.

CFA, on 59 items, was then conducted using the hold-out sample ($n = 819$) in order to (a) confirm the factor structure, and (b) re-select items. Results were inconclusive about model fit: While the root mean square error of approximation (RMSEA) and standardized root mean squared residual (SRMR) suggest the model has reasonable fit (.065 and .072, respectively), the comparative fit index (CFI) and goodness of fit index (GFI) were not good (.746 and .739, respectively). All the loadings, however, are large (all statistically significant) and in the expected direction. It is possible the relatively poor fit was due to correlated residual errors among the items within factors. Taken together, this is sufficient evidence to retain the factor structure and construct the scales accordingly.

Table 14 presents the results of the CFA, showing standardized parameter estimates of the items on their specified factor. Based on these results, we decided to exclude an additional six items (items 35, 42, 53, 62, 70, and 71) because of the relative low loadings. Items 53 and 62 had loadings that were at our .30 threshold; however, their loadings of .30 and .31 were not impressive given the other items assigned to that factor. Appendix A shows all items organized by the proposed factors.

Table 14. Confirmatory Factor Analysis Results: Estimated Standardized Loadings of the Items on Assigned Factors

Item	Brief Description	Estimated Standardized Loading on Assigned Factors
1	strongComputerSkillsBefore	0.44
3	academicConfidenceBefore	0.55
5	personalConfidenceBefore	0.48
11	typingSkillsBefore	0.36
15	useToDoList	0.46
16	canMutiTaskOk	0.45
17	didAssignmentsOnTimeInSchool	0.48
18	hardToStickToSchedule	0.55
19	keepUpWithReadings	0.58
21	skimNewMaterial	0.51
22	revisitConfusingMaterial	0.68
23	organizeNotes	0.53
24	procrastinateStudying	0.67
25	considerAlternatives	0.63
26	setGoals	0.69
27	awareOfExpectations	0.54
28	periodicallyReview	0.58
29	chooseBestSolution	0.75
30	awareOfStudyStrategies	0.54
31	createOwnExamples	0.61
32	goodJudgeOfComprehension	0.57
33	havePurposeForEachStudyStrategy	0.35
34	changeStrategiesWhenNotWorking	0.58
35	breakDownStudyingToSmallSteps	0.17
36	importantToUnderstandThoroughly	0.57
38	wantToLearnAsMuchAsPossible	0.74
39	fearOfFailureOftenMotivates	0.72

Table 14. (Continued)

Item	Brief Description	Estimated Standardized Loading on Assigned Factors
40	desireToCompletelyMasterMaterial	0.46
42	expectToDoWell	0.20
43	believeWillReceiveExcellentGrades	0.78
44	confidentAboutDoingWellWhenEnrolled	0.76
45	primaryReasonEnhanceCareerOpsCivilian	0.72
46	primaryReasonEnhanceCareerOpsMilitary	0.71
47	certainICanmasterSkills	0.69
48	certainICanDoCoursework	0.80
49	canFigureOutMostDifficult	0.81
50	canDoAlmostAllIfPersistent	0.77
51	certainCanRememberInformation	0.43
52	certainCanSelfMotivate	0.35
53	canLearnEvenIfHard	0.30
56	preferSmallDailyProjects	0.35
58	enjoyTasksRequiringNewSolutions	0.86
59	preferImportantTasks	0.84
60	dontCareHowItWorks	0.81
62	haveCertainFixedIntelligence	0.31
63	cantChangeIntelligenceMuch	0.38
66	neverKnowWhereIStand	0.36
70	neverTryThingsUnsureOf	0.25
71	earnMyRespect	0.26
75	frustratedWhenCantGrip	0.67
76	whenUnclearImpulseIsToClarify	0.58
77	cantStandLeavingUndone	0.90
78	dontPerformWellWithVagueExpectations	0.87
79	preferLearningInCommunity	0.76
80	importantToKnowInstructor	0.60
81	likeCoursesWithGroupWork	0.52
82	preferGroupToSoloAssignments	0.88
83	learnBetterDiscussingWithOthers	0.90
84	enjoyLearningFromOthers	0.65

Note. $n = 819$. Bolded loading refers to items that were excluded due to relatively low loading on the assigned factor.

Scale Statistics

As shown in Table 14, 53 items were selected to construct five scales representing each of the factors found in our EFA and CFA analyses. Table 15 shows scale statistics. Inter-scale correlations are shown in Table 16. The distributions and internal consistency reliability coefficients of the scales are reasonable. The estimated reliabilities for Intolerance of Ambiguity and Need for Achievement are especially good given the relatively small number of items on which they are based. In addition, correlations among the scale scores shown in Table 16 are supportive of the construct validity of the scales. It makes theoretical sense that Motivation/Self-Determination and Study Skills/Conscientiousness are relatively highly correlated. It also makes sense that Motivation/Self-Determination and Study Skills/Conscientiousness are negatively

correlated with Performance Goal Orientation. This is because individuals who are high on Performance Goal Orientation are motivated by the outward appearance of their performance (i.e., extrinsic motivation), not by an underlying motivation to understand and learn (i.e., intrinsic motivation). Earlier research has indeed found a similar pattern of relationships between these constructs (Colquitt & Simmering, 1998; Rawsthorne & Elliott, 1999).

Table 15. Scale Statistics

Scale	Number of Items	Minimum	Maximum	Mean	SD	Internal Consistency Reliability (Coefficient Alpha)
Motivation/ Self-Determination	19	19	95	82.03	9.83	.92
Intolerance of Ambiguity	6	6	30	18.85	5.15	.86
Performance Goal Orientation	8	8	40	17.61	5.49	.79
Need for Social Interaction	3	3	15	10.19	3.29	.84
Study Skills/ Conscientiousness	17	17	85	65.77	9.59	.89

Note. The whole sample ($n = 2,370$) was used for these analyses.

Table 16. Scale Intercorrelations

Scale	1	2	3	4	5
1 Motivation/ Self-Determination	1.00				
2 Intolerance of Ambiguity	.08	1.00			
3 Performance Goal Orientation	-.30	.08	1.00		
4 Need for Social Interaction	.39	.04	-.08	1.00	
5 Study Skills/ Conscientiousness	.67	.17	-.23	.30	1.00

Note. $n = 2,370$. Bolded correlations are significant, $p < .01$.

Tables 17 and 18 show subgroup differences for the scale scores. There are no substantial gender differences. However, there were some noticeable race/ethnicity differences. Both Blacks and Hispanics scored higher as a group on Intolerance for Ambiguity than Whites. With regard to Black/White differences, this result is consistent with past research (e.g., Putka, Kilcullen, & White, 2004). However, Blacks and Hispanics also scored higher than Whites on Study Skills/Conscientiousness. In addition, to a lesser degree Blacks scored higher than Whites on Need for Social Interaction.

Table 17. Gender Differences

Scale	Male		Female		Effect Size
	Mean	SD	Mean	SD	
Motivation/ Self-Determination	82.19	9.77	81.46	10.06	-0.07
Intolerance of Ambiguity	18.69	5.14	19.46	5.15	0.15
Performance Goal Orientation	17.55	5.39	17.82	5.83	0.05
Need for Social Interaction	10.19	3.26	10.18	3.40	0.00
Study Skills/ Conscientiousness	65.60	9.60	66.41	9.50	0.08

Note. $n_{Male} = 1,872$. $n_{Female} = 498$. Standard effect size = $(M_{female} - M_{male})/SD_{All}$. Bolded values are significant, $p < .01$.

Table 18. Race/Ethnicity Differences

Scale	White		Black		Hispanic		Effect Size	
	Mean	SD	Mean	SD	Mean	SD	B/W	H/W
Motivation/ Self-Determination	81.83	9.95	82.96	8.92	82.42	9.55	0.11	0.06
Intolerance of Ambiguity	17.94	5.04	20.52	4.90	20.11	4.85	0.50	0.42
Performance Goal Orientation	17.36	5.31	17.95	5.84	17.99	5.46	0.11	0.11
Need for Social Interaction	10.18	3.14	10.69	3.38	9.69	3.57	0.16	-0.15
Study Skills/ Conscientiousness	65.05	9.49	67.17	8.98	67.22	9.88	0.22	0.23

Note. $n_{White} = 1,355$. $n_{Black} = 548$. $n_{Hispanic} = 285$. B/W standard effect size between Black and White = $(M_{Black} - M_{White})/SD_{All}$. H/W standard effect size between Hispanic and White = $(M_{Hispanic} - M_{White})/SD_{All}$. Bolded values are significant, $p < .01$.

Table 19 shows the correlations between the scale scores and other relevant demographic variables. While a number of the correlations are significant, none are particularly large or meaningful.

Table 19. Correlations Between the Scales and Demographic Variables

Scale	Age	Level of Education	Pay Grade	Years in the Army	Other Computer Courses Taken
Motivation/ Self-Determination	.11	.14	.15	.11	.12
Intolerance of Ambiguity	.01	.05	.01	-.02	-.03
Goal/Achievement Orientation	-.07	-.04	-.08	-.03	-.06
Need for Social Interaction	.05	.07	.08	.01	.04
Study Skills/ Conscientiousness	.11	.15	.16	.10	.13

Note. $n = 2,370$. Bolded correlations are significant, $p < .01$.

Criterion-Related Validity

This section examines the extent to which the proposed EAPQ scales taken individually and/or all together predict scores on the Pace criterion. Table 20 shows the zero order correlations between each scale score and the criterion. All of the correlations are significant and in directions that make theoretical sense. For example, it is consistent with the literature that Intolerance for Ambiguity and Performance Goal Orientation have a negative relationship with a criterion assessing academic performance. All of the correlations are less than .20, and we believe that this modest level of correlation is reasonable. Given the academic nature of the Pace criterion, we anticipate that aptitude-related variables (e.g., general cognitive aptitude and past academic performance) would have much higher relationships with our performance outcome.

Table 20. Zero-Order Correlations with the Criterion

Scale	Criterion: Number of Courses Ahead of Pace
Motivation/Self-Determination	0.15
Intolerance of Ambiguity	-0.11
Goal/Achievement Orientation	-0.10
Need for Social Interaction	0.16
Study Skills/ Conscientiousness	0.12

Note. $n = 2,370$. All correlations are significant, $p < .01$.

Table 21 shows the statistics associated with using all five scale scores simultaneously to predict the Pace criterion. The multiple R associated with this regression is .234. The beta-weights of scale scores provide a sample-specific means of optimally combining the scale scores to predict the Pace criterion. However, this multiple R would be an overestimate of the observed relationship based on data from a different sample. Therefore, the multiple R was adjusted using an appropriate shrinkage formula to provide an unbiased estimate of the predictability of the composite (e.g., Rozeboom, 1978). The multiple R adjusted for shrinkage is .226. Given the temperament/motivational nature of these scales and the potential effect of indirect range restriction in the current sample mentioned earlier this is not a bad level of prediction.

Table 21. Regression Analysis with All the Scales Predicting the Criterion Concurrently

	Unstandardized Coefficients		Standardized Coefficients	p
	B	Std. Error	Beta	
(Constant)	0.840	0.353		.017
Motivation/Self-Determination	0.012	0.005	.069	.016
Intolerance of Ambiguity	-0.041	0.007	-.129	.000
Goal/Achievement Orientation	-0.014	0.006	-.046	.029
Need for Social Interaction	0.060	0.011	.121	.000
Study Skills/Conscientiousness	0.008	0.005	.047	.083

Note. $n = 2,370$.

Given that no zero-order validities estimates (see Table 20) dramatically outperformed the others, we did not try regression analyses with subsets of scales. Additionally, the zero-order validity estimates for individual items that were excluded from the scales were examined to see

if any of them could be added to improve the level of prediction (see Table 11). However, most of the excluded items have low individual correlations with the Pace criterion and none showed any promise beyond the level of prediction demonstrated by the five scale scores.

Differential Prediction

Differential prediction/bias analyses were conducted for gender, Black versus White race/ethnicity, and Hispanic versus White race ethnicity effects. Across all five scales there were no effects for gender. That is, (a) the correlation between each scale and the Pace criterion was not significantly affected by gender at the $p < .01$ level and (b) performance on the criterion was not either under- or over-predicted for males or females relative to the overall sample. The main effect due to the Black/White variable was statistically significant ($p < .01$) for Intolerance of Ambiguity and Goal/Achievement Orientation, suggesting that these scales may slightly underestimate performance on the Pace criterion for Blacks (or overestimate performance for Whites). However, the effect is rather small (Beta = 0.090 and Beta = 0.056, respectively). There were no other significant Black versus White effects at the $p < .01$ level. Finally, the main effect due to the Hispanic/White variable was statistically significant ($p < .01$) for Motivation/Self-Determination and Study Skills/Conscientiousness, suggesting that the model may slightly overestimate performance for Hispanics. However, these effects were rather small (Beta = -0.062 and Beta = -0.073, respectively). There were no other significant Hispanic v. White effects at the $p < .01$ level. Taken together, there is very little evidence of differential prediction for these scales relative to gender or the two race/ethnicity comparisons examined.

Discussion

Summary of Results

The factor analysis approach was able to develop EAPQ scale scores that assess relatively independent constructs. The EFA and CFA identified 53 items associated with five scales, and the scale scores show correlations among each other supporting the hypothesis that they measure independent constructs (see Table 16). These scales also showed strong internal consistency reliabilities as illustrated in Table 15, supporting the hypothesis that the items in each scale measure the same characteristic to a reasonable extent. In addition, the scales show relationships with each other and the examined demographic variables that make theoretical sense, providing additional evidence in support of the construct validity of the scales.

There is however, one significant concern. As described in the Factor Analysis section of this report, a number of items showed substantial relationships with factors that do not make theoretical sense. This observation, taken with the missing data for the last four items, suggests that the match between item/variable titles and item responses in the data set might not be completely accurate. If this suspicion is true, analyses of a corrected data set might show a different structure. That is, more items could load substantially on factors that make sense and/or a different set of scale could be identified. While this concern calls into question whether all of the 85 analyzed items are on the correct scale, it does not take away from the evidence that the EAPQ items are as a group relatively predictive of the Pace Criterion. Corrections of any item labeling mistakes would most likely lead to *better* construct validity evidence and higher estimates of criterion-related validity.

As indicated in the Criterion-Related Validity section, the validity evidence for the scales taken individually and as a group is good, but not spectacular. However, it is important to note that with regard to the distribution of values on the Pace criterion, the sample ($n = 2,370$) is not representative of the population ($N = 43,846$). In fact, the behind- and on-pace students are under-represented in this sample relative to ahead-of-pace students. Likely indirect range restriction for the sample relative to the population means that criterion-related validity evidence may be underestimating the relationship between the EAPQ scales and the Pace criterion in the population of interest. That is, if the sample was more representative of the population, the criterion-related validity estimate would likely have been *greater*.

Implication for Current Use of the Questionnaire

The version of the EAPQ that is currently being used has been modified since the data analyzed for this report were collected; however, the similarities are sufficient to make some inferences about the current version of the instrument, clarify questions that still need to be answered, and support recommendations for future research.

- Taken as a whole, the items are predictive of the Pace criterion and are potentially helpful in deciding whether a Soldier is ready to start classes in the eArmyU program.
- The five scales that were discovered here make conceptual sense and are somewhat related to the scales that are currently used; however, some questions remain:
 - Would the same scales emerge with the current version of the questionnaire?
 - Would the same scales emerge with a data set that is known to be free of potential problems? With a clean data set, more than 53 items might associate themselves with scales.
 - Would the same scales emerge when the sample consists of individuals who completed the EAPQ when they were eArmyU applicants instead of eArmyU participants?
- How would the validity results differ in a sample of Soldiers that was more representative of the population in terms of Pace? It is very likely that the results would improve.
- Would the predictive power of the items/scales persist in an operational context? Sometimes when people know the test will affect an outcome they value, they distort their responses to make themselves appear more positive (i.e., faking good). This phenomenon could reduce the capacity of the EAPQ to assess readiness.
- How well does the EAPQ assess readiness in the context of other available sources of information (e.g., ASVAB scores, TABE scores, and GPA in other recent educational experiences)?
- How well does the EAPQ predict other important outcome variables (i.e., criteria) like eArmyU GPA and eventually completion of a degree?

The bottom line here is that the results presented in this report suggest that the EAPQ items, as a group, are probably useful to the processes of determining readiness for participation in the eArmyU program. However, more research is needed.

Recommendation for Future Research

We suggest conducting validity analyses using currently collected (i.e., operational) EAPQ responses. That is, responses from eArmyU participants that took the current version of the questionnaire when they applied to the eArmyU program. These data would optimally be accompanied by (a) other available predictor scores (e.g., ASVAB, TABE Scores, GPA from other recent courses), and (b) other criterion variables (e.g., eArmyU GPA and degree completion).⁴ Such an effort would include the following steps:

- Factor analyses need to be conducted to establish that the five scales discovered in this study generalize to the current version of the questionnaire used in the operational context.
- ACES counseling subject matter experts (SMEs) could be consulted with to identify all of the sources of information that are used and how they are used to provide guidance to Soldiers considering enrollment in the eArmyU program.
- Criterion-related validity analyses could be conducted to assess the predictive power of the EAPQ in the operational context and relative to other potential sources of information (i.e., ASVAB, TABE scores, GPA from recent course work).
- These criterion-related validity analyses could also assess the extent to which the EAPQ can predict other important outcomes (e.g., eArmyU GPA and degree completion).

Based on the information derived from these steps, analysts could (a) confidently establish scales, (b) make definitive recommendations about which items to include or drop, (c) confirm the operational validity of the current version of the questionnaire, and (d) make recommendations about how the EAPQ could be used in the process of advising Soldiers who are considering participation in the eArmyU program. In addition, specific and empirically defensible EAPQ cut scores or benchmarks could be identified to help guidance counselors in evaluating a Soldier's readiness for online learning. Advice on the use of the EAPQ could also include detailed guidance in how to combine EAPQ scores with other sources of information (e.g., TABE and ASVAB scores) in the context of other important educational outcomes (e.g., eArmyU GPA and likelihood of degree completion) in addition to Pace.

⁴ Retaining Social Security Numbers (SSNs) and/or other individual identifiers for these eArmyU participants would be very helpful for obtaining some of these data from available databases (e.g., ASVAB scores from the enlisted master file [EMF]).

References

- Belt, B.S., & Kozlowski, S.W.J. (2002). Goal orientation and ability: Interactive effects on self-efficacy, performance, and knowledge. *Journal of Applied Psychology, 87*, 497-505.
- Colquitt, J.A., & Simmering, M.J. (1998). Conscientiousness, goal orientation, and motivation to learn during the learning process: A longitudinal study. *Journal of Applied Psychology, 83*, 654-665.
- Kozlowski, S.W.J., Gully, S.M., Brown, K.G., Salas, E., Smith, E.A., & Nason, E.R. (2001). Effects on training goals and goal orientation traits on multi-dimensional training outcomes and performance adaptability. *Organizational Behavior and Human Decision Process, 85*, 1-31.
- Le, H., Casillas, A., Robbins, S.B., & Langley, R. (2005). Motivation and skills, social, and self-management predictors of college outcomes: Constructing the Student Readiness Inventory. *Educational and Psychological Measurement, 65*, 482-508.
- Putka, D.J., Kilcullen, R.N., & White, L.A. (2004). Temperament inventories. In D. Knapp, R. McCloy, & T. Heffner (Eds.), *Validation of Measures Designed to Maximize 21st-Century Army NCO Performance* (Technical Report 1145). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.
- Rawsthorne, L.J., & Elliott, A.J. (1999). Achievement goals and intrinsic motivation: A meta-analytic review. *Personality and Social Psychology Review, 3*, 326-344.
- Rozeboom, W. W. Estimation of cross-validated multiple correlation: A clarification. *Psychological Bulletin, 1978*, 1348-1351.

Appendix A

Items and Their Final Scale Assignments

Scale/ Item	Item Description	Original Scale*
<i>Motivation / Self-Determination</i>		
1	I had strong computer skills <i>prior</i> to my enrolling in eArmyU. ^a	CSE
3	Prior to enrolling in eArmyU, I had a lot of confidence in my ability to use the Internet to do academic- related research. ^a	CSE
5	Prior to enrolling in eArmyU I had a lot of confidence in my ability to use the Internet to perform personal tasks, such as purchasing items or making travel arrangements. ^a	CSE
32	I am a good judge of how well I understand something.	MCA
33	I have a specific purpose for each study strategy I use.	MCA
34	I change strategies when I fail to understand something I am working on.	MCA
36	It is important for me to understand as thoroughly as possible what is taught in courses I take.	MAL
38	I want to learn as much as possible in any course I take.	MAL
39	My fear of performing poorly in a course is often what motivates me.	MAL
40	I desire to completely master the material presented in the courses I take.	MAL
43	I believe I will receive excellent grades in the courses I take in the future.	MAL
44	I was confident when I first enrolled in eArmyU that I would do very well. ^a	MAL
45	My primary reason for taking eArmyU courses is to enhance my career opportunities once I am out of the Army.	MAL
46	My primary reason for taking eArmyU courses is to enhance my opportunities for promotion in my Army career.	MAL
47	I'm certain I can master the skills taught in the courses I take.	SEF
48	I'm certain I can do my coursework, even when there are other interesting things I could otherwise do.	SEF
49	I can figure out how to do even the most difficult course work.	SEF
50	I can do almost all the work in my courses as long as I don't give up.	SEF
81	I like courses that involve group work.	NSI
<i>Intolerance of Ambiguity</i>		
75	I get frustrated when I can't get a grip on something.	TFA
76	When an issue is unclear, my impulse is to clarify right away.	TFA
77	I can't stand to leave things undone.	TFA
78	I don't perform well when there are vague expectations and goals.	TFA
79	I prefer learning in an environment where I feel a sense of community with other students.	NSI
80	When I take a course, it's important to me that I get to know the course instructor.	NSI
<i>Performance Goal Orientation</i>		
51	I'm certain I can remember information presented in my courses.	SEF

Scale/ Item	Item Description	Original Scale*
52	I'm certain I can motivate myself to do the work required of me in order to do well in my courses.	SEF
56	I prefer to think about small daily projects rather than long term ones.	NFC
58	I really enjoy tasks that involve coming up with new solutions to problems.	NFC
59	I would prefer a task that is important, intellectual and difficult over a task that is somewhat important but does not require much thought.	NFC
60	It's enough for me that something gets the job done; I don't care how or why it works.	NFC
63	Your intelligence is something about you that you can't change very much.	NFC
66	I never know where I stand with other people.	LOC
<i>Need for Social Interaction</i>		
82	Given the choice, I would prefer working on an assignment in a group instead of working on it by myself.	NSI
83	I learn better when I can discuss my ideas with others.	NSI
84	When I work in a team, I enjoy learning from other team members.	NSI
<i>Study Skills / Conscientiousness</i>		
11	My basic typing skills, <i>prior</i> to my enrolling in eArmyU were strong. ^a	CSE
15	Whenever I have a lot of things to do in a day, I make a "to do" list and check off tasks as I complete them.	TMG
16	Having to attend to several tasks at the same time has no effect on my ability to perform these tasks effectively.	TMG
17	When I was in high school or college, I handed in my assignments on time.	TMG
18	I find it hard to stick to a study schedule.	TMG
19	I make sure to keep up with the weekly readings and assignments for the courses I currently take or have taken in the past.	TMG
21	Before I study new course material thoroughly, I often skim it to see how it is organized.	SSE
22	When I become confused about something I'm reading for a course, I go back and try to figure it out.	SSE
23	When I am taking notes, I prioritize and organize the information I am recording.	SSE
24	When preparing for a test, I prefer to wait until the last minute to do my studying.	SSE
25	I consider several alternatives to a problem before I attempt to solve it.	MCA
26	I set specific goals before I begin a task.	MCA
27	I am generally aware of what my teachers expect me to learn.	MCA
28	I periodically review to help me understand important relationships between concepts.	MCA
29	I think of several ways to solve a problem and choose the best one.	MCA
30	I am aware of what strategies I use when I study.	MCA
31	I create my own examples to make information more meaningful.	MCA

Scale/ Item	Item Description	Original Scale*
<i>Excluded</i>		
2	I currently have strong computer skills. ^b	CSE
4	I have a lot of confidence right now in my ability to use the Internet to do academic-related research. ^b	CSE
6	I have a lot of confidence <i>right now</i> in my ability to use the Internet to perform personal tasks, such as purchasing items or making travel arrangements. ^b	CSE
7	I often find myself getting confused when I'm carrying out basic computer functions, such as downloading a file or searching for a file on my computer. ^c	CSE
8	If I could work it into my schedule, I would spend as much time as I could surfing the Internet.	CSE
9	My <i>lack</i> of computer skills or Internet knowledge often interferes with my ability to do my best work in the eArmyU courses I take. ^b	CSE
10	I often run into technical problems (computer malfunction, bad Internet connection, missing software programs, etc.) that interfere with my ability to do my best work in the eArmyU courses I take. ^b	CSE
12	I often took part in chat sessions and other online activities (not necessarily related to course work) prior to my enrolling in eArmyU. ^c	CSE
13	I have a systematic way (for example, an appointment book, diary, electronic calendar, or other method) to keep track of my daily and weekly schedule. ^c	TMG
14	I can accurately gauge the amount of time the tasks I'm scheduled to perform will actually take. ^c	TMG
20	When I study the readings for my courses, I outline the material to help me organize my thoughts. ^c	SSE
35	I try to break studying and problem solving down into smaller steps. ^c	MCA
37	It is important for me to do well compared to others in the courses I take. ^c	MAL
41	Sometimes I'm afraid that I may not understand what is being taught in a course as thoroughly as I'd like to understand it. ^c	MAL
42	I expect to do well in the courses I take in the future. ^c	MAL
53	Even if the material in a course is hard, I can learn it. ^c	SEF
54	I can do even the hardest work in my courses, if I try. ^c	SEF
55	I would rather do something that requires little thought as opposed to something that is sure to challenge my thinking abilities. ^c	NFC
57	I like tasks that, once I've learned how to do them, require little thought. ^c	NFC
61	I usually end up deliberating about issues even when they do not affect me personally. ^c	NFC
62	You have a certain amount of intelligence and you really can't do much to change it. ^c	NFC
64	You can learn new things, but you can't really increase your basic intelligence. ^c	NFC
65	I usually get what I want in life. ^c	LOC
67	If I do not succeed on a task, I tend to give up. ^c	LOC
68	I usually convince others to do things my way. ^c	LOC
69	People must be the master of their own fate. ^c	LOC
70	I never try anything that I am not sure of. ^c	LOC

Scale/ Item	Item Description	Original Scale*
71	I earn the respect and honors I receive. ^c	LOC
72	Persistence and hard work usually lead to success. ^c	LOC
73	Other people usually control my life. ^c	LOC
74	I get impatient when there are no clear answers. ^c	TFA
85	Completing my eArmyU coursework is a high-priority task for me. ^c	ATS
86	I have enough time during a typical week to take part in activities of my choice, apart from my eArmyU assignments. ^b	ATS
87	I have enough time during a typical week to complete my eArmyU assignments. ^b	ATS
88	My work schedule makes it easy for me set up a regular routine for working on my eArmyU assignments. ^b	ATS
89	When I have the time to work on eArmyU course work, it is easy to find a quiet place where I can concentrate on my work. ^b	ATS
90	I am often interrupted when I sit down to work on my eArmyU course work. ^b	ATS

Note. a = These items are recommended to be revised to be appropriate for Soldiers who have not attended the eArmyU. b = Items dropped from analyses because their contents are inappropriate for Soldiers who have not attended the eArmyU. c = Items dropped based on results the Factor Analyses. *CSE= Computer Self-Efficacy. MCA = Meta-cognitive Awareness. MAL = Motivation and Attitude toward Learning. SEF = Self-Efficacy. NSI = Need for Social Interaction. TFA = Tolerance for Ambiguity. NFC = Need for Cognition/Attitude for Intelligence. LOC = Locus of Control. TMG = Time Management. SSE = Study Skills Efficacy. ATS = Adequate Time to Study.